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CONTENTS

FIBERS OF OLD ARABIC MANUSCRIPTS

Included in the introduction to the descriptive catalog of the Garrett Collection of Arabic Manuscripts in the Princeton University Library, recently published, is a report of the National Bureau of Standards which gives the kinds of fibers found in the papers of 49 of the manuscripts.

The manuscripts tested were dated from the eleventh to the eighteenth century, inclusive. With the exception of three manuscripts, the papers, in about equal proportion, are composed of ramie fibers and flax fibers. Ramie predominates largely in the manuscripts dated to the fourteenth century; flax predominates somewhat in the later manuscripts. The paper of one manuscript of the early seventeenth century is composed of Japanese mulberry fiber, and the fiber of papers of two manuscripts of the eighteenth century is cotton.

The Bureau had previously reported the presence of ramie in a few very old papers, and its presence in so many of these Arabic manuscripts reveals that it was extensively used in the early days of paper making. This appears to be an important contribution to the history of paper making, for, as far as the Bureau knows, there is no previous record of this. It is well known that linen was used in very early times, particularly by the Arabs. Ramie is very similar to linen in both its textile making and paper making properties and therefore has probably been generally classified in old papers as linen. Ramie is also known as rhea and China grass. It is said to be indigenous to India and probably also to China. It has been cultivated in China, Japan, Java, Borneo, Sumatra, and the East Indies for a great many years. It is used abroad for the manufacture of textiles and still, to a small extent, for making paper. The use of cotton apparently was begun about the seventh century. The Bureau has found that the papers of some Chinese and Japanese manuscripts, dating as far back as the sixth century, are composed variously of paper mulberry, mitsumata, and bamboo fibers. Mulberry, mitsumata, and other similar fibers are still used con-

[1] Published with approval of the Director of the Budget.

siderably in making the soft, strong tissues characteristic of those countries.

These papers, like the other oriental papers examined by the Bureau, exhibited little evidence of deterioration. Most of the papers of the Arabic manuscripts had an excellent glazed finish.

RELATION OF CAMERA ERROR TO PHOTOGRAMMETRIC MAPPING

In connection with the work of the different agencies of the Department of Agriculture, large areas of the United States are being photographed from the air. The primary purpose of this photographic work is the checking of crop control and of projects for the prevention of soil erosion. In view of the lack of precise maps for much of this country, it is considered desirable to have these photographs so made that they will also serve for the construction of topographic maps. Unfortunately, the requirements for the two purposes are not parallel. The Department of Agriculture is interested in securing photographs from which areas can be scaled with the least difficulty. This implies photographs made from great altitudes with lenses of long focal length and relatively small angular field of view in order that displacements arising from relief in the terrain may not introduce large errors in areas read from the photographs by planimetric devices. On the other hand, for making topographic maps, photographs covering a wide angular field of view, made with a lens of medium or short focal length, are desirable in order that displacements arising from the presence of relief may be pronounced; such displacements being necessary for the drawing of contours.

Before the possibility of using photographs for these dual purposes can be adequately considered, it is necessary to have a knowledge of the manner in which errors of the airplane camera are propagated and finally appear as errors in the map. Furthermore, a photograph to serve the two purposes will probably involve compromises from both standpoints and cameras of high precision must be used in order to obtain the best results from the photographs. In RP1177 in the Journal of Research for February, Irvine C. Gardner, chief of the Bureau's Optical Instruments Section, derives the formulas covering camera performance and presents the information necessary for the preparation of specifications for precision cameras, and for the preparation of specifications for photographic projects. This report has been prepared as a part of committee work for the American Society of Photogrammetry.

RECTANGULAR UNIFORM-CHROMATICITY-SCALE COORDINATES

To meet the need for a practical system of specifying colors that will represent chromaticity differences more uniformly than the standard coordinate system adopted by the International Commission on Illumination in 1931, the Maxwell triangle proposed by Deane B. Judd in 1934 has been modified and transferred to rectangular coordinates. The resulting color-mixture diagram is desirable in having the equal energy point at the origin with the coordinate axes constituting reasonable boundaries between the colors. The first quadrant is green, the second is blue, the third is purple, and the fourth is red, orange, and yellow.

Through the use of transformation equations, values can be transformed from or to the ICI System. Tables have been prepared for computing trilinear coordinates in the new system directly from spectral values of energy distribution, reflection, or transmission; and coordinates have been located in the new system for the spectrum locus, the Planckian locus, and other typical energy distributions. Figures are available which show comparisons between the new diagram and the ICI diagram, Judd's UCS diagram, and McAdam's modification of the UCS diagram.

The limitations of the new diagram spring from the inaccuracy and incompleteness of the experimental data on uniformity of chromaticity differences. Until more complete experimental values are available it is not desirable to establish any additional system as a universal standard, but the proposed system does offer a useful secondary system for those who need it, and illustrates some convenient characteristics which should be incorporated in any new mixture diagrams which may be adopted as standards provided the experimental facts permit.

ANALYSIS OF MIXTURES OF ETHYLENE OXIDE AND CARBON DIOXIDE

The use of ethylene oxide as a fumigant has gained considerable impetus in this country and abroad during the last 8 years. It is generally used with about 90 percent of carbon dioxide to

produce a noninflammable mixture. The analysis of this simple mixture has caused some difficulty, in spite of the remarkable reactivity of the ethylene oxide. The methods so far reported have been limited in number and are not always satisfactorily accurate. They have involved a combination of gravimetric or gasometric methods, always with a final estimation of the ethylene oxide alone by titrimetric procedure. A new method has been developed by Joseph R. Branham and Martin Shepherd of the Bureau's Chemistry Division, which involves only direct gasometric measurements, employing a standard burette-manometer-compensator unit. Its accuracy is commensurate with that obtained by the best of the previous methods, and both components of the mixture may be determined in less time and with less effort than was formerly required for the determination of ethylene oxide alone. For the complete description, RP1175 in the Journal of Research for February should be consulted.

FRACTIONATION OF PETROLEUM

In the fractional distillation of petroleum, constant-boiling fractions are frequently encountered which are composed of mixtures of two or more hydrocarbons having nearly the same boiling point. Often, such mixtures can be separated into their components by subjecting them to other kinds of fractionation as, for example, crystallization or extraction. If, however, the mixtures are composed of hydrocarbons having substantially different values for the temperature coefficient of vapor pressure, they can be separated by distillation at a pressure of a few hundred millimeters of mercury above or below the original.

In their study of the "methyloctane" fraction of petroleum (part of API Research Project 6 at the Bureau), Joseph D. White and A. R. Glasgow, Jr., have found that the paraffin-naphthene mixtures which are constant-boiling at normal pressure are separable when distilled at reduced pressures. Those which are constant-boiling in the region 200 mm. Hg may be separated by distilling at normal pressure. The separation arises from the greater change in boiling point with pressure of the naphthene component. For hydrocarbons normally boiling near 140° C., the mean interval between boiling points at 760 and 215 mm. Hg is about 42° C. for paraffins, and about 43.2° C. for naphthenes.

A fraction of Oklahoma petroleum boiling at 141° C, from which the aromatic hydrocarbons previously had been removed, was separated by distillation at 215 mm Hg into a fraction containing the bulk of a naphthene constituent and one enriched in paraffins. From the former, nearly pure 1,2,4-trimethylcyclohexane was isolated by crystallization from solution in liquid dichlorodifluoromethane. Continued distillation of the paraffinic fraction at normal pressure, alternated with distillation at 215 mm Hg, yielded a fraction containing 85 mole percent of a nonane, probably 2,3-dimethylheptane. The 1,2,4-trimethylcyclohexane constitutes about 0.1 percent, and the isononane about 0.05 percent of the original petroleum.

The boiling point, freezing point, density, refractive index, and critical solution temperature in aniline have been determined for the 1,2,4-trimethylcyclohexane and the isononane. Comparison of the properties of the 1,2,4-trimethylcyclohexane with those reported for the stereoisomers of this compound indicates that the petroleum hydrocarbon is either 1(*cis*),2(*trans*),4(*cis*)-trimethylcyclohexane or 1(*cis*),2(*trans*),4(*trans*)-trimethylcyclohexane.

The complete paper on this subject appears as RP1173 in the Journal of Research for February.

COMPOSITION OF A MIDCONTINENT PETROLEUM FRACTION

The program of the American Petroleum Institute at the Bureau has included the determination of the constituent hydrocarbons in a midcontinent petroleum distilling between 100° and 130° C. The methods used in this work by Robert T. Leslie were chiefly physical-chemical, though the toluene content was removed by controlled nitration. As explained in the Journal of Research for February (RP1174), the material was first carefully distilled and large quantities were found to concentrate within relatively narrow boiling ranges. By far the largest quantity distilled between 117° and 128° C, and most of the work was concentrated on this material. Seven hydrocarbons comprising one-sixth of the volume of the material after the first laboratory distillation were isolated or concentrated, so that they can be identified when more data on synthetic hydrocarbons are available. About one-tenth of the volume was identified as *n*-octane, about one-fortieth each as methylcyclohexane, toluene, 2-methylheptane, *m*-dimethylcyclo-

hexane and a naphthene which is possibly *cis-o*-dimethylcyclohexane, and about one one-hundredth as *trans-o*-dimethylcyclohexane.

After the isolation of these materials, redistillation caused about one-sixth of the original volume to concentrate again in the same temperature ranges. Crystals from these fractions studied under the microscope appeared to be additional quantities of the isolated constituents.

About one-twelfth of the material remained in small concentrations at 102° to 106° C, 108.5° to 110.5° C, and 112° to 116° C. These fractions would not crystallize in this state, and distillation of the fractions boiling between 108.5° and 110.5° C with acetic acid did not show much promise of separating the naphthenic from the paraffinic constituents. The first concentration was suspected of containing ethylcyclopentane and 2, 2-dimethylhexane, the second of being one or more of five isooctanes with one or more of three trimethylcyclopentanes; and the third of being some of three trimethylcyclopentanes. The volumes of these fractions were such that any one of the hydrocarbons in them probably constitute less than one one-hundredth of the original volume of the fraction.

From the properties of all the known hydrocarbons which could occur in the fraction of petroleum under consideration, conclusions were drawn as to the likelihood of their presence in the petroleum.

MUTUAL INDUCTANCE AND FORCE BETWEEN TWO COAXIAL HELICAL WIRES

In the Journal of Research for February (RP1178) Chester Snow derives a formula for the mutual inductance and force between two coaxial helical wires which in addition to the well-known current-sheet formula contains small correction terms. One of these is due to the axial components of current, one due to the finite diameters of the wires, and one which depends upon the relative azimuths of the helices arises naturally from the actual helical form of the windings. The pitch of the windings may be different in the two, but each is considered so small in comparison with the cylindrical radii that terms relatively smaller than the square of this ratio may be neglected. The number of turns is not necessarily an integer.

ELASTIC PROPERTIES OF CAST IRON

An optical method for measuring the deflection of cast-iron transverse test bars up to the breaking strength has been developed by A. I. Krynitsky and C. M. Saeger, Jr., of the Bureau's Metallurgy Division. Deflection is determined by measuring the distance between a reference point and a rubber band mounted on the test bar. The deflection readings are independent of any movement of parts of the testing machine.

As reported in RP1176 in the February Journal of Research, irons were heated to maximum temperatures of 1,400°, 1,500°, 1,600°, and 1,700° C. Test bars 1.2-inch diameter were cast vertically, bottom poured in green-sand molds at 100°, 150°, 200°, and 250° C above the liquidous temperature. Transverse properties of the test bars were determined by interrupted loading and by direct loading up to breaking load. From the data obtained, the total, plastic, and elastic deflections, modulus of rupture, relative modulus of elasticity, total, plastic, and elastic resilience were determined for all test bars investigated. The load-elastic deflection curves are not straight lines. The relative modulus of elasticity as determined on the straight-line portion of the elastic deflection curve and also at the breaking load. In general, the lowest and highest elastic properties were observed for the maximum heating temperatures of 1,400° and 1,700° C, respectively. These properties showed a tendency to decrease with an increase of pouring temperature.

The microstructure of the test bars was examined. The finer graphite particles are associated with higher transverse properties. A laminated, pearlite-like structure observed on some unetched specimens, and the presence of large graphite particles subdivided into hexagonal-like grains, are of particular interest.

THERMAL EXPANSION OF GROUND-COAT ENAMEL FRITS

The important role played by thermal expansivity in determining the usefulness of enamels is widely recognized. Certain relations have not, however, been fully established, such as that between the "critical" temperature as determined for heating a specimen and that for cooling. These rela-

tions, and also the total differential contraction between the enamel and the iron base, were studied by William N. Harrison, Benjamin J. Sweo, and Stephen M. Shelton, as well as the evidence of "permanent" dimensional changes in the enamel frits resulting from heating and cooling cycles. As set forth in the Journal of Research for February (RP1172), constants were determined for each enamel, which, when substituted in simple first-order equations, permit the computation of the expansivity of each frit at any stated temperature or in any temperature interval between 25° C and the critical temperature.

STRUCTURAL PROPERTIES OF MASONRY WALLS

Tests on six different types of masonry walls, (part of the Bureau's investigation of the structural properties of low-cost house constructions) are described in Building Materials and Structures Report BMS5, which is now available. The compressive and transverse strengths of some of these wall constructions had been determined in previous investigations, but information on their other structural properties was lacking.

The following constructions were represented: High-strength brick, cement mortar, excellent workmanship; medium-strength brick, cement-lime mortar, commercial workmanship; medium-strength brick, cement-lime mortar, excellent workmanship; structural clay tile on end, cement-lime mortar, excellent workmanship; structural clay tile on side, cement-lime mortar, excellent workmanship; and stone-concrete block, cement-lime mortar, excellent workmanship.

The specimens were subjected to compressive, transverse, concentrated, impact, and racking loads to simulate loads actually applied to the wall of a house. Usually three duplicate specimens were tested.

The deformation under load and the set after the load was removed were measured for uniform increments of load up to the maximum, except for concentrated loads, for which only the set was determined. The results not only give information about these particular types of masonry walls, but should prove valuable as a criterion for judging new or unusual types of construction.

Copies of this report are obtainable from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 15 cents each.

STANDARD TESTS ON BUILDING BRICK

Most organizations and individuals must depend upon the written word for directions in carrying out laboratory testing methods. Obviously, where accuracy and reproducibility of results depend upon rigid adherence to a particular testing technique, standard methods should be very explicit. The test of a standard method is the agreement in the results of independent laboratories working on the same or comparable samples.

The results of such a test are reported in the January number of the Bulletin of the American Society for Testing Materials in a paper by W. J. Krefeld of the Civil Engineering Research Laboratories of Columbia University and J. W. McBurney of the Bureau, entitled "Comparison of Standard Tests on Building Brick by Two Laboratories."

The program involved the selection of 30 whole bricks as nearly alike as could be judged by visual inspection. These 30 bricks were numbered from 1 to 30, wrapped separately and divided at random into two samples of 15 bricks each. Each of the two cooperating laboratories received one of these samples and the following tests were made:

1. Water absorption was determined by 24-hour cold immersion and by 5-hour boiling on the whole bricks after they had been dried.

2. The transverse strength was measured after redrying.

3. Water absorption by 24-hour cold immersion and by 5-hour boiling was redetermined on both sets of half bricks resulting from the transverse test.

4. Compressive strength, flatwise, was determined on the dried half bricks constituting the first set and the second set of halves was exchanged with the cooperating laboratory.

5. Both laboratories determined water absorption by 24-hour cold immersion and by 5-hour boiling on these exchanged halves, and then measured compressive strength on the same specimens after drying.

The only instructions were that both laboratories should use the methods bearing the ASTM designation "C 67–37." No consultation or correspondence took place between the laboratories on the subject of methods until after completion of all tests. Both laboratories completed their tests and submitted their reports to a third party without knowledge of the results obtained by the other cooperator.

A statistical study of the data resulting from these tests appears to justify the following conclusions:

1. The agreement between the two laboratories testing identical specimens was better than that obtained by either laboratory testing the two halves of the same brick. In other words, the accuracy of the absorption tests exceeded the reproducibility of the samples, unless the samples were identical.

2. The saturation coefficients (ratios of absorption by 24-hour cold absorption to absorption by 5-hour boiling) differed by 0.002 for sample 1 and by 0.000 for sample 2 when identical specimens were tested by both laboratories.

3. Standard Methods of Test C 67–37 provides a water-absorption test of satisfactory accuracy and reproducibility, and that two laboratories working independently and without previous comparison of methods should check each other so closely on identical samples indicates that C 67–37 provides sufficiently exact directions for procedure.

4. The accuracy and reproducibility of the compressive strength test is poor in comparison with the absorption test. Random errors of considerable magnitude are apparent and a systematic error caused by difference in strength of capping materials is possible.

DIFFERENCES IN THE POROSITIES OF DIFFERENT SECTIONS OF A BRICK

In a study of pore structure and its relation to the resistance of brick to disintegration by freezing and thawing, under investigation by R. T. Stull and P. V. Johnson, it became evident that the porosity varied within different parts of a brick, because of the manner in which the brick was formed or uneven pressure in forming.

As a means of determining the extent of the variation in porosity within certain bricks, four specimens were selected to include a salmon stiff-mud, a hard-burned stiff-mud, a salmon dry-press, and a hard-burned dry-press brick.

Each brick was sawn across the flat side into nine equal sections, thus giving sections representing one center, four corners, and four middle sections between two corner sections and adjacent to the center section.

The porosity of each section was determined by the air expansion method. The maximum porosities were obtained with the center and the minimum with a corner section, and the porosities of the middle sections a little higher than the mean of the two. In the hard-burned, stiff-mud brick of 20.7 percent porosity, as determined on the whole brick, the sections varied in porosities from a minimum of 17.2 percent at a corner to 22.7 percent as the maximum at the center, while the salmon stiff-mud brick, with 29.5 percent porosity determined on the whole brick, varied in sectional porosities from 27.0 percent as the minimum at a corner to 31.6 percent as the maximum at the center.

In the salmon and hard-burned dry-press bricks there was no definite trend in direction of change in porosities, such as was observed in the stiff-mud bricks. Although the variation in porosities of the sections were, in general, as great as those of the stiff-mud bricks, the variation did not occur in a systematic manner. The hard-burned, dry-press brick varied in sectional porosity from 23.1 to 26.0 percent, with an original porosity for the whole brick of 24.6 percent, while the salmon dry-press brick, whose original porosity for the whole brick was 29.9 percent, varied in porosity from 27.6 to 33.7 percent for the sections.

AIR-SETTING REFRACTORY MORTARS

Among the tests to which 23 brands of air-setting refractory mortars have been subjected by the Bureau are the fusion block and heat soak tests. Although the fusion block test has been used for a number of years in testing enamels, feldspars, and pottery glazes, it has not been considered suitable for refractories. However, because of the low fusibility of one of the constituents in many of the air-setting mortars or of the mortar itself, these blocks appear to be of considerable aid when judging the quality of the mortar. Blocks having a ½-inch-deep sample compartment filled with mortar were heated at 1,425° C. for 24 hours, and others with compartments ⅛-inch deep and ½-inch deep were heated at 1,500° C. for 5 hours. Brick units were heated with the fusion test blocks. These units consisted of two half-bricks laid flatwise between two full-sized bricks, using 1/16-inch mortar joints in some units and ⅛ inch in others. The units therefore contained one vertical and two horizontal joints. The results of the fusion test block corroborate and accentuate the conclusions drawn from an examination of the brick and mortar units after heating. For example, if, as a result of fusion, a large portion of the mortar had flowed from the compartment, then the mortar joint in the unit would be glassy and bloated, with evidences of having flowed from

the vertical joint. High shrinkage in the blocks would be indicated by cracks in the mortar joints and, if excessive migration of the sodium silicate took place in the block sample, as would be indicated by fusing and flowing of the surface of the sample, then a bulged appearance of the joint around the edges was noted.

PLASTIC CALKING MATERIALS

During the past 10 years the Bureau has been called upon to test thousands of samples of plastic calking materials intended for use in Federal Government buildings. The purpose of testing cannot be well explained without a consideration of the purpose of the materials. Essentially, they are intended to seal narrow openings or joints between parts of the structure which cannot be successfully sealed with relatively inelastic materials, such as cement mortar. Structural movements caused by temperature changes, settlement, and volume changes resulting from wetting and drying of the structure, cause these joints to vary in width. The plastic calking compounds are intended to fill narrow openings and to remain sufficiently pliable to adjust themselves to such structural movements. The compositions are, in general, a mixture of treated oils with fillers to form a mastic of suitable consistency. Particularly in masonry buildings, this type of joint filler is subjected to severe conditions. Masonry, as well as many other building materials, is porous and hence capillary effects come into consideration. The removal of some of the oil from the mastic by the pores of the adjoining material causes considerable shrinkage. The mastics usually contain volatile matter, varying from 1 to 25 percent, which evaporates, causing further shrinkage. When shrinkage occurs, the mastic may separate from the materials which it is supposed to seal, and lose a sufficient amount of plasticity to render the performance under service conditions unsatisfactory.

The tests designed to determine the quality of the mastic joint fillers may be described as performance tests, which place the samples under conditions as nearly as possible like those in service. They also simulate the most difficult condition, namely, that of joint extension, which shows whether the bonding properties are sufficient and whether the plastic properties are such as to enable the mastic filler to maintain a seal. Other properties which are determined are the ability of the material to remain in joints in warm weather when the plastic condition is another important property when the mastic is in contact with porous materials of high capillary properties.

In these tests, an exceedingly large number of failures have occurred, which indicate that fabrication methods have not been sufficiently standardized, and possibly also that the producers have not given adequate consideration to all of the conditions which the materials are called upon to withstand. An investigation is in progress which involves a study of the composition, fabrication, and properties of these products. An analysis of failures has led to the conclusion that one of their most common causes is excessive shrinkage. Another is the lack of proper adhesive qualities, permitting an easy separation of the mastic from the structural materials to be sealed together. A third cause is too rapid drying out and embrittlement of the mastic, which may be defined as a loss of plasticity. Still another occasional cause of failure as shown in certain samples is stratification and breakage in the middle of the joint, as if the cohesive properties were at fault.

The concern of the builder in the failure of such a minor part of the structure is not merely that of replacement, but rather the injury that may be caused to other parts through the use of a poor joint filler. If the mastic fails to seal the joint, water will find entrance to the interior and cause considerable damage, and in many cases necessitate expensive repairs. If the consistency is at fault, the mastic may flow from the joint and over the face of exterior building materials. Then there will be great difficulty in cleaning because the oil may penetrate into masonry materials, and hence cleaning is not merely a matter of removing the mastic from the surface. Furthermore, if the oil-retaining properties are insufficient, the oil will spread from the joints into adjoining masonry units, producing an unsightly condition which is practically impossible to eradicate.

In the course of study on these materials, an article has been prepared by D. W. Kessler for publication in the Review of the Society of Residential Appraisers, which discusses in some detail the purpose, uses, composition, and properties of the plastic joint fillers. The article also outlines a few field tests which are suitable for use at the site of construction projects, where labora-

tory facilities are not available. It is believed that the use of such tests by building superintendents or calking contractors might prevent some of the undesirable results experienced through the use of improperly fabricated plastic joint fillers.

SURVEY OF ROOFING MATERIALS IN THE SOUTHEASTERN STATES

As part of the Bureau's research program on building materials and structures, a survey has been made of the weathering qualities and extent of use of various roofing materials in the southeastern States.

This survey, which was made with the cooperation of the representatives of the reconditioning section, Home Owners' Loan Corporation, both in Washington and in the field, involved approximately 3,500 miles of travel. Detailed studies of the weathering characteristics of the different roofing materials were carried out in Greensboro, N. C., Columbia, S. C., Savannah and Atlanta, Ga., Jacksonville and Orlando, Fla., Birmingham, Ala., Knoxville, Tenn., and Charleston, W. Va.

Observations were made on the extent of use of the various roofing materials on new and old construction in the cities included in the survey; also a tabulation was made, by States, of the kinds of roofing materials on more than 10,000 rural and small town dwellings, along approximately 2,500 miles of highway.

Approximately 400 photographs, showing types of weathering of roofing materials and features of design and construction of roofs, were taken. From these, 48 were selected for publication in the report of this survey. This report, the sixth to be issued in the series entitled "Building Materials and Structures", BMS6, is obtainable from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 15 cents a copy.

STRUCTURAL PROPERTIES OF "FABRIHOME" CONSTRUCTIONS FOR WALLS AND PARTITIONS

Report BMS11 of the series on building materials and structures, which was released a short time ago, describes tests on 18 specimens of walls and partitions submitted by the Curren Fabrihome Corporation. The specimens were manufactured by the Johnson Metal Products Co. and represented constructions marketed under the trade name "Fabrihome." These constructions consist of non-load-bearing panels having welded sheet-steel frames with plywood outside faces and gypsum-board inside faces for walls, and gypsum-board faces for partitions. The panels were designed to be fitted into a concrete frame and fastened by springs.

The specimens were subjected to transverse, concentrated, and impact loads, simulating those in an actual house. The loads were applied to both faces of wall specimens. For each of these loads, three like specimens were tested.

The deformation under load and the resulting set were measured for uniform increments of load up to the maximum, except for concentrated loads, for which the set only was determined. The results are presented graphically and in tables.

Copies of BMS11 are obtainable from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 10 cents.

NEW AND REVISED PUBLICATIONS ISSUED DURING JANUARY 1939

Journal of Research [2]

Journal of Research of the National Bureau of Standards, volume 22, number 1, January 1939 (RP1163 to RP1171, inclusive). Price 30 cents. Annual subscription, 12 issues, $3.50.

Journal of Research of the National Bureau of Standards, title page, corrections, and contents to volume 20, January to June 1938 (RP1059 to RP1109, inclusive). Free on application to the Bureau.

Research Papers [2]

[Reprints from the October and November 1938 Journal of Research]

RP1137. A determination of the absolute ohm, using an improved self inductor. Harvey L. Curtis, Charles Moon, and C. Matilda Sparks. Price 15 cents.

[2] Send orders for publications under this heading only to the Superintendent of Documents, Government Printing Office, Washington, D. C. Subscription to Technical News Bulletin, 50 cents per year; Journal of Research, $3.50 per year (United States and its possessions, and Canada, Colombia, Cuba, Dominican Republic, Ecuador, Guatemala, Honduras, Mexico, Newfoundland (including Labrador), Panama, and Venezuela); other countries, 70 cents and $4.50, respectively.

RP1143. Exhaustive fractionation of the "extract" portion of the lubricant fraction from a midcontinent petroleum. Beveridge J. Mair and Charles B. Willingham. Price 10 cents.

RP1145. Chemical constitution of the "extract" portion of the lubricant fraction from a midcontinent petroleum. Beveridge J. Mair, Charles B. Willingham, and Anton J. Streiff. Price 10 cents.

Building Materials and Structures [2]

[Persons who wish to be notified of new publications in the "Building Materials and Structures" series as soon as they are available should write to the Superintendent of Documents, Government Printing Office, Washington, D. C., asking that their names be placed on the special mailing list maintained by him for this purpose.]

During the past month the following publications in this series have been issued:

BMS5. Structural properties of six masonry wall constructions. Herbert L. Whittemore, Ambrose H. Stang, and Douglas E. Parsons. Price 15 cents.

BMS6. Survey of roofing materials in the southeastern States. Hubert R. Snoke and Leo J. Waldron. Price 15 cents.

BMS11. Structural properties of the Curren Fabrihome Corporation's "Fabrihome" constructions for walls and partitions. Herbert L. Whittemore, Ambrose H. Stang, and Vincent B. Phelan. Price 10 cents.

Simplified Practice Recommendations [2]

R154–38, Cupola refractories. (Supersedes R154–34). Price 10 cents.

R172–38. Stock folding boxes for garments and dry cleaning. Price 5 cents.

Technical News Bulletin [2]

Technical News Bulletin 261, January 1939. Price 5 cents. Annual subscription, 50 cents.

MIMEOGRAPHED MATERIAL

Letter Circulars

[Letter Circulars are prepared to answer specific inquiries addressed to the National Bureau of Standards and are sent only on request to persons having definite need for the information. The Bureau cannot undertake to supply lists or complete sets of Letter Circulars or send copies automatically as issued.]

LC539. Sound absorption coefficients of the more common acoustic materials. (Supersedes LC506.)

LC540. Artificial abrasives and abrasive products. (Supersedes LC527.)

LC541. Classification of acoustic materials. (Supersedes LC505.)

LC542. List of publications relating to paint, painting, lacquer, bitumens and allied subjects. (Supersedes LC478.)

RECENT BUREAU ARTICLES APPEARING IN OUTSIDE PUBLICATIONS [3]

Time measurements. F. Wenner. J. Washington Acad. Sci. (450 Ahnip St., Menasha, Wis.) 28, 505 (Dec. 15, 1938).

Rating aviation fuels in full-scale aircraft engines. Report of the Cooperative Fuel Research Committee. H. K. Cummings. Society of Automotive Engineers J. (29 West 39th St., New York, N. Y.) 43, 497 (December 1938).

Methods of treating anodic coatings on magnesium and aluminum alloys. R. W. Buzzard and J. H. Wilson. United States Patent No. 2,138,023 (U. S. Patent Office, Washington, D. C., 10 cents a copy).

The change in potential of silver-silver halide electrodes with time. E. R. Smith and J. K. Taylor. Jubilee issue Roczniki Chemji (Warsaw, Poland) (December 1938).

The theory of impact testing. D. J. McAdam and R. W. Clyne. Symposium on Impact-Testing (Am. Soc. Test. Materials, 260 South Broad St., Philadelphia, Pa.) (December 1938).

Evaluation of motion-picture film by semimicro testing. J. E. Gibson and C. G. Weber. J. Documentary Reproduction (Am. Library Assn., 520 North Michigan Ave., Chicago, Ill.) 1, No. 4, 282 (Fall, 1938).

The combination of hydrochloric acid and sodium hydroxide with hide, tendon, and bone collagen. John Beek, Jr., J. Am. Leather Chemists' Assn. (Ridgway, Pa.) 33, 621 (December 1938).

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[2] Send orders for publications under this heading only to the Superintendent of Documents, Government Printing Office, Washington, D. C. Subscription to Technical News Bulletin, 50 cents per year; Journal of Research, $3.50 per year (United States and its possessions, and Canada, Colombia, Cuba, Dominican Republic, Ecuador, Guatemala, Honduras, Mexico, Newfoundland (including Labrador), Panama, and Venezuela); other countries, 70 cents and $4.50, respectively.

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Isotonic solutions. I. The chemical potential of water in solutions of sodium chloride, potassium chloride, sulfuric acid, sucrose, urea, and glycerine at 25° C. George Scatchard, W. J. Hamer, and S. E. Wood. J. Am. Chem. Soc. (Mills Bldg., Washington, D. C.) **60**, 3061 (December 1938).

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